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REGIONAL TARGETED WATER QUALITY NETWORK

QUALITY ASSURANCE PROJECT PLAN

2015-2017 Cycle

(As Amended 9/2016)

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Summary of Amendments

- Additional Text: Amended text highlighted in red
- New Site Additions
- Continuous Monitoring Component Updated
- Updated Site & Data Management Tables
- Updated Site Location Map

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1.0 Project Name: Regional Targeted Water Quality Network

2.0 Project Requested by: Bureau of Environmental Analysis and Restoration and Standards (BEARS)

3.0 Date of Project: November, 2015- September, 2017.

4.0 Project Fiscal Information: Job Number 35950000, Activity Code V4AR

5.0 Project Officer: Alex Dinkel, Project Officer, NJDEP, BFBM **(Alexander.Dinkel@dep.nj.gov)**

6.0 Special Training Needs/Certification

All staff participating in this project will be trained in the proper collection techniques as outlined in the "NJDEP Field Sampling Procedures Manual," August 2005; the document available online at the NJDEP's webpage, <http://www.state.nj.us/dep/srp/guidance/fspm/ >.

BFBM is certified by the Office of Quality Assurance (certified lab ID # 11896) for the following parameters for this project: dissolved oxygen, temperature, pH, conductance, and turbidity.

7.0 Project Background

The Department initiated the Barnegat Bay Ten-Point Action Plan in 2010 as a model for regional water quality assessment and restoration. The *Comprehensive Regional Assessment Using A Rotating Basin Approach* encourages the development of measures to restore, maintain and enhance water quality uses tailored to address an issue or a region. Measures developed are designed to maximize effectiveness and efficiency in achieving positive environmental outcomes. This approach is consistent with recent USEPA guidance related to strategies and priorities for water quality restoration, "A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program.

This holistic approach is used to evaluate the State's waters as part of the Integrated Report. The Integrated Report includes the "303(d) List of Water Quality Limited Waters" (303(d) List), which satisfies the Section 303(d) requirement to biennially produce a list of waters that are not meeting surface water quality standards (SWQS) despite the implementation of technology-based effluent limits and thus require the development of total maximum daily loads (TMDLs) or watershed restoration plans to restore water quality. The 303(d) List is the only part of the Integrated Report that is subject to regulatory requirements. The Integrated Report also includes an "Integrated List of Waters" (Integrated List) that combines the reporting requirements

of Sections 305(b) and 303(d) of the Act by depicting the use assessment results for every applicable designated use in each assessment unit as ”fully supporting”, “not supporting”, or “insufficient information”.

Under the *Comprehensive Regional Assessment Using A Rotating Basin Approach*, the Department focuses on targeted sites located in New Jersey’s five water regions (Atlantic Coastal, Lower Delaware, Northwest, Raritan, and Northeast) during each Integrated Report cycle. The targeted water region approach results in a comprehensive assessment of the entire state every 10 years.

The assessment process is a two-step evaluation process: Step 1 uses improved computer technology to apply the assessment protocols in the **Integrated Water Quality Monitoring and Assessment Methods** document **(Methods Document)** to determine preliminary assessment decisions; Step 2 involves an in-depth analysis incorporating water quality data results from step 1 along with other factors such as hydrology, geology, land use, biological habitat conditions, meteorology, restoration activities, point and nonpoint sources, use designation, stream classification, and other relevant environmental considerations to determine overall water quality. During Step 2, a team of analysts conducts a comprehensive assessment that includes confirmation of water quality conditions based on the above factors through the application of Geographic Information Systems (GIS) tools, aerial and satellite-based photography, field observations, and visual assessments. The objective is to produce an in-depth analysis applying across-the-board watershed information to make assessment decisions with a high degree of confidence. This would allow the Department to address multiple water resource concerns based on an assessment of the specific environmental conditions affecting the targeted region.

The Department is improving confidence in its assessment decisions by increasing the number of samples required for certain parameters, referred to as the target sample size. The new target sample size has been selected to more accurately capture variable water quality conditions such as natural variability, seasonal changes, varying hydrologic conditions, as well as underlying natural conditions and the effects of anthropogenic activities. The target sample size for conventional parameters is 20 samples and for metals and toxic pollutants it is 8 samples. These samples will be collected over at least a 2-year period within a specified five-year reporting period. Sampling newly selected sites as specified in the QAPP amendments will commence in October 2016. The second year of sampling for these sites will be addressed in a new QAPP to be prepared in 2017. The assessment methodology including sample size requirements are discussed in details in the 2014 Methods Document.

The result of implementing the *Comprehensive Regional Assessment Using A Rotating Basin Approach* is the increase of temporal resolution at the cost of spatial resolution. The Regional Targeted Water Quality Network was developed to meet the data need by creating a monitoring network that is regionally focused, rotates on a 2-year cycle, and collects enough samples to meet the target sample size at each sampling station.

For the selection of sampling stations, BEARS technical staff conducted a comprehensive review of selected water regions. The staff used prior monitoring data, Integrated List assessment results, restoration activities, hydrology, land use, potential pollutant sources, and other environmental data to select potential monitoring locations. The multi-step process using water quality data and GIS tools resulted in the selection total of twenty-five water quality sites. The prioritization criteria for selecting the water quality sampling stations included:

1. AUs without any water quality data (highest priority)
2. AUs with some water quality data but not enough to make a decision
3. AUs with marginal decisions either for impaired or non-impaired
4. AUs based on data over 10 yrs. old higher priority
5. AUs needing follow-up sampling or special situation (see prior assessment comments)
6. AUs with restoration projects that potentially could show improvement
7. AUs with a TMDL or planned TMDL
8. AUs with non-support biology but no water quality especially if biology recently degraded
9. Station represents more than one AU
10. AUs with C1 or Outstanding National Resource Waters
11. AUs with public water supply intake or reservoir
12. Number of potential point or non-point pollutant sources
13. Avoid AUs with a lake station on the main stem or represents AU especially with recent data
14. Avoid AUs with a fixed network station
15. Avoid AUs with recent HUC14 Stations
16. Avoid small tributaries
17. Avoid AUs that are small or headwaters (try to use downstream site)

The final outcome was WM&S selecting total of twenty-five monitoring stations and fourteen temperature stations for the Regional Targeted Water Quality Monitoring Network, 2015-2017 Cycle.

8.0 Project Description

For the period between November, 2015 and September , 2017, the RTWQN will consist of twenty-five regional targeted water quality monitoring stations. This represents an addition from the thirteen sites in the original project design. Sampling of new sites will commence October 2016. A subset of eight stations were selected for Continous Diurnal monitoring. In addition to the 25 monitoring sites, fourteen sites were selected by BEARS for temperature monitoring; review of discrete data necessitated an examination of baseline and yearly data for an in-depth analysis.

Regional Targeted Water Quality Stations:
Twenty-five stations will be monitored for the parameters included in attachment B. These stations will be monitored for conventional/nutrient parameters and for metals parameters of the frequency detailed in Section 13.0, Sampling Schedule. Discharge measurements will be made at all stations during each sampling event.

9.0 Project Objectives

The project objective is to collect water quality samples that meet the needs for the Regional Comprehensive Assessment outlined in the 2014 Methods Document. Section 7.0 "Project Background" summarizes the new assessment approach that includes regionally focused assessments and more frequent data requirements. Starting in 2015, sampling will begin in selected regions to collect data that will be used in the 2018 Integrated Report. In addition, the project will collect diurnal data to help assess water quality conditions at certain stations suspected to be impacted by excessive nutrients and linked to significant diurnal dissolved oxygen (DO) and pH swings.

10.0 Monitoring Network Design

Water Quality Stations: Twenty-five stations (list included in Attachment A) will be sampled for conventional/nutrient parameters each month of the sampling year with the exceptions of November and January. A period of at least two weeks between sampling events is required. The stations will also be sampled for metals parameters four months out of the sampling year (October, February, June, August). A list of physical/ chemical parameters is included in Attachment B. Discharge measurements will accompany each sample at every station during each sampling event.

Diurnal Dissolved Oxygen Stations:
A subset of eight stations are selected from the water quality monitoring sites for Diurnal monitoring.

11.0 Sampling Procedures

11.1 General Procedures: Sampling frequencies for conventional parameters (nutrients, suspended solids, chloride, etc.) and field parameters will be monthly with the exception of November and January. Discharge (flow) measurements at each non-tidal station will be taken during each sampling event by USGS or BFBM staff utilizing similar procedures. A full explanation of BFBM's procedures for discharge measurement can be found in Attachment C. At tidally impacted sites, monitoring will be at low, slack tide. Metals monitoring will occur four times per year (October, February, June, August) to produce both high flow and low flow data. Sample bottles for analytical parameters will be provided by the contracted New Jersey certified laboratory. Sample volume and container type will be as described in the respective laboratory's "Quality Manual" and/ or SOP, approved by the Office of Quality Assurance (OQA). This information is also included in Attachment B.

11.2 Cleaning Sample Equipment: Because the possibility of contamination of samples is great, all sampling devices used to collect water quality samples for the parameters listed will be cleaned as thoroughly as possible between each use using a 1% solution of lab detergent (Liquinox) and Deionized (PICO) water, followed by a thorough rinse with deionized (PICO) water. All equipment cleaning will be performed at BFBM's preparation laboratory. Metals samples will be collected via a center of flow grab sample directly into a new one-use sample container, so no additional cleaning procedures are necessary.

11.3 Field Precautions for Invasives: To prevent the potential spread of nuisance or invasive organisms such as Didymosphenia sp. from stream to stream, all nets, waders, etc. will be decontaminated in the field between sites by spraying with an antibacterial spray such as Fantastik (heavy duty) and rinsing with tap water. Also, the use of felt-soled waders will be avoided.

11.4 In-Stream Analytical Sampling Procedures and Parameters:

The collection of water quality samples will be accomplished using the Equal Width Increment (EWI) sampling method and a splitter churn to obtain cross sectional composite samples. Water column sample collection for metals will be center of flow grab samples. Samples will be collected as per "NJDEP Field Sampling Procedures Manual," August 2005 Section 6.8.2; the document available online at the NJDEP's webpage, <http://www.state.nj.us/dep/srp/guidance/fspm/ >.

Field readings for analyze immediately parameters (dissolved oxygen, pH, specific conductance, water temperature, air temperature and turbidity) will be made at each site during each sampling event. The chemical and field parameters are listed Attachment B.

Discharge measurements will be made at each station (where applicable) during each sampling event using BFBM standard operating procedures

(Attachment C) or United States Geological Survey procedures http://training.usgs.gov/TEL/Nolan/SWProcedures/Index.html

11.5 Diurnal Dissolved Oxygen Procedures:

In the event of diurnal monitoring, a minimum of two datasondes will be deployed during a given two week period. Parameters recorded will be Temperature, Dissolved Oxygen, Dissolved Oxygen Saturation (%), pH, Turbidity and Specific Conductivity. Deployments will be throughout the growing season, when photosynthetic activity will likely affect parameters such as dissolved oxygen.

11.5.1 Deployment

Datasondes will be checked against another calibrated Datasonde unit at deployment for possible Drift. This duplicate analysis will be in a standard bucket filled with a grab sample of stream water. Compared values which differ by 10% or more may indicate a problem with the probe and will be identified in the data report. All values are to be recorded in the appropriate fields on the USGS Diurnal Water Quality Monitor form. The following steps will be performed.

- Place datasondes in the grab sample bucket.
- Wait for 5 minutes to elapse to allow sensors to equilibrate..
- Record readings from both units for Temperature (Temp), Specific Conductivity(SC), Dissolved Oxygen in mg/L (D.O.) Dissolved Oxygen saturation (D.O. %), pH and Turbidity (NTU)

11.5.2 Retrieval

Datasondes will be checked against another calibrated Datasonde unit at retrieval. This duplicate analysis will be done in a standard bucket filled with a grab sample of stream water. Compared values which differ by 10% or more may indicate a problem with the probe and will be identified in the data report. All values are to be recorded in the appropriate fields on the Diurnal Water Quality Monitor form. Follow the steps below

- Removed deployed unit from the water. **Do not** clean the probes of the deployed unit.
- Place datasondes in the grab sample bucket.
- Wait for 5 minutes to elapse allow sensors to equilibrate.
- Record values from both units for Temp, SC, D.O. D.O. %, pH and NTU.
- Remove the datasondes. Clean/rinse the probe heads of the deployed unit with Deionized Lab Pure water.

- Placed the cleaned deployed unit back in the bucket.
- Wait for 5 minutes to elapse to allow sensors to equilibrate.
- Record values from both units for Temp, SC, D.O., D.O.%, pH and NTU.

After measurement time has been achieved the datasondes will be retrieved and the data will be downloaded. Downloaded data will be screened for errors then exported into an excel spread sheet to be supplied to BEARS and the BFBM's data team.

All Datasondes used in the project will be calibrated according to manufacturer's specifications. Calibrations will be recorded for each parameter in a designated logbook. Collected data will be screened for errors and noted in the excel file particular to the site measured. Calibration metadata will be stored in a dedicated field book and held for QA purposes. Dataset verification and validation will be discussed in the *Data Validation* section of this document.

11.5.3 Non Direct Measurement (Secondary Data)

Secondary data such as Calibration records, Weather, Site Location, Site Conditions and Issues will be recorded for each site prior to deployment and at retrieval. A digital picture of the location will be taken at deployment and retrieval. Field data will be recorded utilizing the USGS Diurnal Water Quality Monitor Field form.

11.5.4 Deployment Requirements

In order for a successful monitoring event, a protocol concerning deployment must be followed. The protocol is broken down into the following steps:

1. Deployment locations will be located with a global positioning system (GPS) if not placed at an established site with previous locational information.
2. Datasonde units must be completely submerged in a consistently shaded area of flowing water. Center flow channel stream placement is optimum.
3. Sensor cluster of the unit should be aimed downstream to prevent scouring of the probe heads.
4. All units must be secured via a cable and lock, affixed to a tree or similar fixture on the stream bank.
5. A site sketch of the unit's placement in a stream must be drawn for retrieval by other BFBM personnel if necessary.

6. Steps should be taken to conceal the unit should the location have foot traffic by non DEP personnel to prevent tampering.

11.6 **Temperature Monitoring Procedures**

Temperature monitoring sensors are deployed at selected locations, secured by a stainless steel cable that is fixed to a large stationary object. Temperature sensors are weighted down with bricks or other weighted devices to prevent the sensor from floating to the top of the water column. The following deployment protocols need to be followed.

1. Sensors are deployed in a consistently shaded region of flowing water in the stream channel. Pools and riffles are to be avoided.
2. Sensors are checked against a certified NIST thermometer before deployment to ensure accuracy.
3. When a sensor is deployed, a temperature reading will be collected by a certified NIST thermometer.to post check and correct the data for drift.
4. Sensors that deployed longer than 3 months require collected data to be downloaded from the unit. This should be done periodically (every 3 months) to prevent data loss from lack of available memory on the sensor.
5. When downloading data from a sensor, a temperature reading must be taken via a NIST certified thermometer for data quality checks.
6. When sensors are removed from a stream, a temperature reading via a NIST certified thermometer will be taken and compared to sensor data for correction purposes.

12.0 Data Quality/Quality Control Requirements

12.1 Sampling Locations: Sampling locations will be established using an approved global positioning system (GPS) device (Trimble Geo Explorer 3 or newer model). Subsequently, all sampling locations will be verified by sampling staff during each sampling event using a GPS device. In addition photos will be taken and site sketches will be made for each sampling location.

12.2 Testing by BFBM

All pH meters, dissolved oxygen meters, conductivity meters and thermometers shall be operated and maintained according to the "Regulations Governing the Certification of Laboratories and Environmental Measurements", N.J.A.C. 7:18. BFBM is certified by the Office of Quality Assurance (certified lab ID # 11896) for all parameters listed below:

Temperature, pH, Conductance and DO are measured using a Hach model # HQ40D. The Hach HQ40D is a multi-parameter water quality system that combines temperature, pH, conductance, and luminescent dissolved oxygen (LDO) probes into one meter.

Temperature: The probe is calibrated with a NIST certified thermometer on a quarterly basis. Records of the calibration shall be maintained by the BFBM. (**BFBM Standardized Analytical Method for Temperature (11.1300), 2005**

pH: The probe is calibrated on a daily basis per the manufacturer recommendations. The pH meter is calibrated each day of use, including calibration with two standard pH buffers bracketing the value to be measured. After calibration, a standard buffer with pH within the calibration range shall be measured without any control adjustments to check the calibration. When the pH meter is in use for longer than a 3 hour period, the pH of the third buffer shall be checked once every three hours. If the pH differs by more than 0.2 pH units from the standard buffer value, the meter shall be recalibrated. Records of all calibrations and calibration checks shall be maintained in the field log. (**BFBM Standardized Analytical Method for Determining pH by the Electrometric Method, 2008)**

Conductance: The probe is calibrated on a daily basis per the manufacturer recommendations. The probe is calibrated each day of use with a certified standard which corresponds to the expected range of the values to be measured. Records of all calibrations and calibration checks shall be maintained in the field log. **(BFBM Standardized Analytical Method for Specific Conductance (10.0870), 2006)**

DO: A Winkler check is performed on a weekly basis and the meter (Hach HQ40D) is barometrically compensated and checked at each sampling site. Records of all calibrations and calibration checks shall be maintained in the field log. (**BFBM Standard Analytical Method for Dissolved Oxygen by the Luminescence Measurement of Dissolved Oxygen (LDO), 2013)**

Turbidity: HACH Model 2100P turbidimeter is calibrated once a month per manufacturer recommendations. The meter is then checked with certified standards for accuracy within the calibration range during each day of use. Records of all calibrations and calibration checks shall be maintained in the field log. **(BFBM Standard Operating Procedure for Field Turbidity Measurement, 2000)**

Other Parameters:

Barometer: Thommen TX Mechanical Barometer. Measured for LDO meter compensation only. Not used for project's data objectives.
Ambient Air Temperature: Measured for general information purposes only. Not used for project's data objectives.

Relevant Documents

NJDEP Field Sampling Procedures Manual (2005).
NJAC 7:18 - Regulations Governing the Certification of Laboratories and Environmental Measurements.

12.3 Additional Testing performed by a NJ Certified Laboratory

Analytical samples will be delivered to a NJ certified laboratory. Testing will be done by a method for which the laboratory has certification (New Jersey Department of Health- Public Health and Environmental Laboratories; laboratory certification number 11036). Quality control procedures (including required calibrations and quality control procedures required by regulation or by the method) shall be defined in the laboratory's Quality Manual (NJ Department of Health Quality Manual : Environmental and Chemical Laboratory Services 7/1/14) or Standard Operating Procedures (SOPs) listed in Attachment E. The QM and SOPs must be approved by the OQA.

NJDOH Analytical SOPs are reviewed annually and are subject to change, therefore the revisions identified in this QAPP may or may not be current. Based on the date the samples are submitted, the current SOP will be followed. All archived SOPs are kept by NJDOH on the network server.

13.0 Sampling Schedule

Sampling frequencies for conventional physical/ chemical parameters (nutrients, suspended solids, chlorides, etc.) and field parameters will be sampled monthly with the exception of November and January per year, for the two year period. Metals monitoring will also occur in the months of October, February, June, and August per calendar year, for the two year period. Discharge measurements will be made during each sampling event by USGS or BFBM staff utilizing the same procedures. Diurnal dissolved oxygen monitoring will occur from June through September.

14.0 Resource Allocation: In order to complete this project as described, at least two full-time staff are required. This will allow for physical/ chemical and diurnal dissolved oxygen sample collection, discharge measurements and data quality assurance and control.

15.0 Quality Assurance

15.1 Sampling Locations: All sampling locations will be established and verified during each sampling visit using global positioning system (GPS) device.

15.2 Laboratory Analysis: All physical/ chemical parameters will be analyzed by a qualified New Jersey certified laboratory. Any laboratory used shall be certified by NJDEP's OQA for the requested parameters. The reporting levels listed in Attachment B are **required** for this project.

15.3 Sample Containers: Sample containers shall be dedicated, single-use. Sample containers shall be provided by the NJ certified laboratory.

15.4 Sample Retention: All samples must be retained for the duration of each analytes respective holding time.

15.5 Chain of Custody: Chain of custody forms are required for all samples forwarded to a NJ certified laboratory for testing. Information to be recorded includes all information required by N.J.A.C. 7:18-5.6(d) and 8.5(c).

15.6 Sample Blanks/Replicates: Each staff member participating in this project will submit one annual field blank sample for physical/ chemical conventional parameters collected in a churn splitter and one annual replicate sample for metals parameters collected via a center of flow grab sample. If blank or replicate samples reveal any sampling deficiencies, an internal field audit will be performed on the relevant staff member(s) by the Project Officer or Supervisor. In addition, the staff member(s) may be subject to an audit by NJDEP's Office of Quality Assurance.

15.7 Diurnal & Temperature Monitoring Parameters:
All measurements will be collected using YSI 6600, 6920, HOBO Loggers and EXO series datasondes. Sensor specifications can be found in Attachment F.

All datasondes used will be inspected prior to deployment. Datasondes will be serviced, maintained and calibrated according to manufacturer's specifications. D.O. Sensor membranes (if applicable) will be inspected for bubbles or wrinkles and be replaced accordingly. pH sensor bulbs will be inspected for scratches and replaced if necessary. Specific Conductivity sensors will be inspected and cleared of any residue (if any).Turbidity sensors will be inspected and wiper assembly verified as functional.

Calibration of the datasondes will take place 1 to 3 days in advance of the deployment. YSI 6600, 6920 and EXO series datasondes feature calibration checks to ensure sensors remain properly calibrated. Calibration issues or failures will be indicated by error messages in the software during calibration.

Dissolved Oxygen: Calibration of the Optical Dissolved Oxygen Sensor will be done using the 1 point air saturation method. This method utilizes a container of water that is continuously sparged with oxygen from an air pump. A period of 10 minutes shall elapse before calibration takes place to

allow temperature and oxygen to equilibrate. The sensor is then calibrated to 100% saturation using the current barometric pressure. The rapid pulse DO sensors report a statistic (DO Charge) that indicates if the probe is operating successfully. Ranges below 25 or exceeding 75 indicate sensor failure. Dissolved oxygen will be checked against a Winkler titration before and after deployment. Differences greater than 0.3 mg/l will require recalibration.

pH: pH sensors will be calibrated via a three point calibration check. The pH standards used will be 4,7 and 10.. pH sensors will report 'Out of Range' errors should sensor output exceeds the normal range. Differences between the standard and measured reading +/- 0.1SU for pH will require recalibration.

Specific Conductivity: Specific Conductivity sensors will be calibrated via a one point calibration check against a standard of 1.413 mS/cm. Conductivity sensors will report 'Out of Range' errors should sensor output exceeds the normal range. Differences between the standard and measured reading exceeding 1% will require recalibration.

Turbidity: Turbidity sensors will be calibrated via a two point calibration check. The sensors will be calibrated against a 0 NTU solution and a 100 NTU solution. Turbidity sensors will report 'Out of Range' should the defined calibration range be exceeded. Differences between the standard and measured reading exceeding 2 NTU will require recalibration.

Temperature: Temperature will be checked against a NIST certified thermometer on a quarterly basis. Temperature differences between the standard and measured reading exceeding 0.1°C require recalibration.

16.0 Data Validation

The Project Officer and the Supervisor are responsible for all initial data validation. If apparent anomalous data is suspected the Project Officer and/or the Supervisor will review the sampling procedures with the field sampler to make sure the proper collection and preservation procedures were followed. Additionally, for nutrient parameters (particularly Ammonia, TKN, Nitrate + Nitrite and Phosphorus), the field sampler, Project Officer and/or the Supervisor may perform further water quality logic tests on the suspect data, as described in the U.S. Geological Survey Open File Report 02/383; 2003, entitled, *"Methods For Quality Assurance Review of Water Quality Data in New Jersey."*

If the data is still suspect, the NJ certified laboratory will be contacted. An internal review of their laboratory procedures and/or calculations used in the analysis of the suspect sample, with special emphasis on transcription of data to assure that no transposition of figures occurred will be conducted. The NJ certified laboratory will be asked to check on equipment calibration. They may be

further requested to reanalyze the retained portion of the sample. (Samples are to be retained by the laboratory for the duration of each analytes respective holding time.) If no problems are found in the analytical laboratory procedures, the data may then be compared to any historical data that might have been collected at the same site prior to the most recent sampling event to see if similar anomalies might have been found previously. The suspect data may also be compared to literature values or standard analytical treatises to verify whether or not the results are within the limits of accuracy of the test method.

For diurnal and temperature monitoring, once the data has been downloaded, it will be screened by the Project Officer. Usability of the dataset will be determined by checks for Drift, errors present (if any) and their extent. Datasondes deployed in the field will be checked for Drift at both time of deployment and retrieval. This check will consist of using another Datasonde alongside the first and comparing readings between the two units. Temperature Sensors will be checked against a NIST certified thermometer before, during and after deployment for Drift.

For the Drift check, the difference between the two readings will be measured and checked against the following parameter criteria:

Parameter	**Minimum**	**Maximum**
Temperature	.1° C	1.5° C
Specific Conductivity	1%	25%
pH	0.1	1.5
Dissolved Oxygen	.3 mg/l	1.5 mg/l or 25%
Turbidity	2 NTU or 5%	25%

Should the difference found to be below the Minimum criteria threshold, then the data will be reported as is.

Should the difference fall between the Minimum and Maximum values, the data will then be reported with a qualifier modifying the value listed via a plus/minus percentage or unit(s).

Should the difference exceed the Maximum range, then the data for that parameter will be deleted. Reasons for any deletions will be added to the data record for future use. Once the comparison check is completed, the data will be screened for errors. Sources of errors can be attributed to the following:

1. Non-stream conditions readings (open air)
2. Hardware failure
3. Tampering by non DEP personnel (causing non stream readings)
4. Fouling.

Errors involving loss of data (i.e. out of water) will be truncated from the dataset. Errors that involved hardware failure and fouling will result in the truncation of data from the moment of failure to the point of normal operation (if any).

If no obvious problems are found after these reviews, the complete data set will be reported with the suspect data identified as such. The BFBM will then conduct its own review of the data, as it relates to the objectives(s) and data accuracy required in this project.

Temperature sensors will follow the same parameter criteria & data review that is used for datasondes.

17.0 Data Storage

Data will be stored locally in electronic format (MS Access). Water quality data will be entered into New Jersey's Water Quality Data Exchange (WQDE) and USEPA STORET Data Warehouse by June of the following year. Continuous Monitoring data will be stored at the Division of Water Monitoring & Standards Continuous Data Monitoring website hosted by Rutgers, the College of NJ. All raw data records shall be maintained for a period of no less than five years. Attachment D contains the complete data storage and availability.

18.0 Performance System Audits

All NJ certified laboratories used are subject to audits and to the requirements of the OQA Laboratory Certification Program as well as internal performance evaluations. The OQA will be notified of field monitoring schedules for possible audits.

19.0 Data Reporting

19.1 Preliminary Reporting of Data

Preliminary analytical data will be reported to BFBM, from the laboratory employed for this project, in electronic format within 21 calendar days from receipt of sample. Samples which yield results considered anomalous by the Project Officer and/ or Supervisor will be validated as specified in section 16.0, Data Validation, before the holding time of the retained sample is expired. If the results remain suspect after an internal review of the laboratory procedures, calculations, and/or on transcription of data has been conducted, then the sample shall be reanalyzed by the laboratory using the retained portion of the sample. This reanalysis shall be performed within the parameter holding time.

19.2 Final Reporting of Data

Final analytical data will be reported to BFBM, from the laboratory employed for this project, in the form of electronic and/ or hard copies of the lab sheets; or in a tabulated form within 40 calendar days from receipt of sample. All data shall be reported in a complete and concise fashion and shall meet the reporting requirements of NJAC 7:18. Routine quality control results must be retained on file for review by the BFBM and the OQA.

Final data and evaluations will be forwarded to the NJDEP Bureau of Environmental Analyses, Restoration and Standards for use in the generation of the biennial New Jersey Integrated Water Quality and Assessment Report [305(b) and 303(d)].

20.0 Assessment, Oversight, and Response

The Project Officer will be responsible for the oversight of all activities relating to this project. The Project Officer will assess field collection functions and make corrections when necessary to maintain the data accuracy as defined in this plan.

21.0 Corrective Action

If any changes or modifications are made to this plan regarding data collection, as it relates to the objectives(s) and data accuracy required in this project, all original signees of the QAPP will be notified.

Attachment A: Project Site List Tables & Map

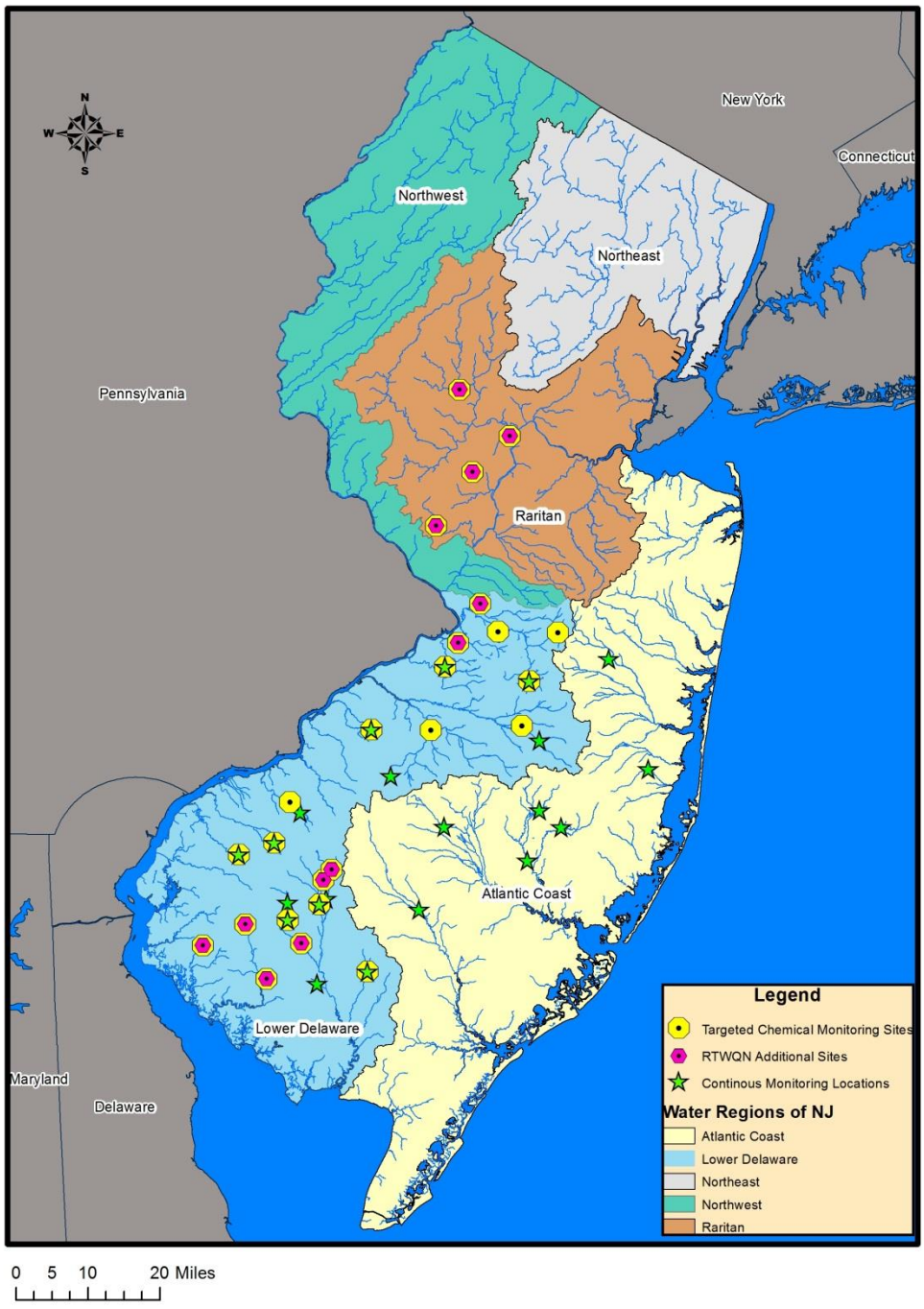
Station ID(WQDE compliant and referenced)	Waterbody/Location	Latitude-dd	Longitude-d	County	Site exists in WQDE already?	Location Type
AN0144	Pole Bridge Br at Split Rock/ Rd Wisaahickon Trail	39.94694	-74.55562	BURLINGTON	Yes	River/stream
AN0122	Lahaway Ck at Rt 537	40.13403	-74.46158	MONMOUTH	Yes	River/stream
01467066	NB Pennsauken Ck at Gaither Dr	39.93765	-74.94938	BURLINGTON	Yes	River/stream
01464290	Jumping Bk at Hockamick Rd	40.03633	-74.53608	BURLINGTON	Yes	River/stream
01411453	Still Run at Rt 40	39.58542	-75.08156	GLOUCESTER	Yes	River/stream
AN0126A	Crosswicks Ck at Ironbridge Rd	40.13604	-74.61820	BURLINGTON	Yes	River/stream
01411675	Muddy Run at Sheep Pen Rd	39.55387	-75.16404	SALEM	Yes	River/stream
01464587	Assiscunk Ck at Rt 628 (Hedding/Jacksonville Rd)	40.06492	-74.75659	BURLINGTON	Yes	River/stream
01477100	Raccoon Ck at Fisslerville Rd	39.70861	-75.20111	GLOUCESTER	Yes	River/stream
01475042	Mantua Ck at Rt 632 (Wenonah ave)	39.79083	-75.16028	GLOUCESTER	Yes	River/stream
01477470	Oldmans Ck at Rt 45	39.68473	-75.29325	SALEM	Yes	River/stream
BFBM000015	Little Ck at County Club Dr/Eayerstwon Rd	39.93801	-74.79341	BURLINGTON	es	River/stream
AN0759	Menatico Ck at Rt 673 (Hance Bridge Rd)	39.45051	-74.95605	CUMBERLAND	Yes	River/stream
01413020	Indian Fields Branch at Bridgeton NJ	39.43447	-75.21857	CUMBERLAND	Yes	River/stream
01413060	Canton Drain near Canton NJ	39.50090	-75.38462	SALEM	Yes	River/stream
01411740	Muddy Run at Parvin Mill Road near Norma NJ	39.50667	-75.12889	SALEM	Yes	River/stream
AN0709	Cohansey River at Beal Rd	39.54475	-75.27486	SALEM	Yes	River/stream
01411457	Little Ease Run at Grant Ave near Franklinville	39.63492	-75.07211	GLOUCESTER	Yes	River/stream
01411461	Scotland Run at Fries Mill NJ	39.65583	-75.05111	GLOUCESTER	Yes	River/stream
0146453250	Crystal Creek near Mansfield Square NJ	40.11312	-74.72286	BURLINGTON	Yes	River/stream
01464523	Back Creek at Hamilton Township	40.19216	-74.66535	MERCER	Yes	River/stream
BFBM000256	Cruser Bk/Roaring Bk	40.45709	-74.68555	SOMERSET	No	River/stream
01402540	Millstone River on Wilhousky St near Manville	40.53013	-74.58800	SOMERSET	Yes	River/stream
01399720	Rockaway Ck at Island Rd	40.62330	-74.72086	SOMERSET	Yes	River/stream
BFBM000011	Stony Bk at Titus Mill Rd Nr Glenmoore NJ	40.34927	-74.78183	MERCER	Yes	River/stream
AN0521	Maple Root Br at Bowman Rd in Jackson	40.08125	-74.32714	OCEAN	Yes	River/stream
AN0551	Forked R N Br at powerlines in Lacey	39.85872	-74.22497	OCEAN	Yes	River/stream
01409815	Wading R W Br at Maxwell	39.67500	-74.54083	BURLINGTON	Yes	River/stream
AN0597	Shoal Br at Jones Mill Rd in Woodland	39.77647	-74.50856	BURLINGTON	Yes	River/stream
01466000	Middle Br Mount Misery Bk at Mount Misery	39.91665	-74.50864	BURLINGTON	Yes	River/stream
AN0562	Mullica R at Burnt House Rd in Waterford	39.74305	-74.75711	BURLINGTON	Yes	River/stream
BFBM000236	Great Egg Harbor River at 8th Street	39.57575	-74.82220	ATLANTIC	Yes	River/stream
BFBM000237	Black Run Bog	39.84453	-74.89719	BURLINGTON	Yes	River/stream
AN0605	Papoose Br at Jenkins Rd in Bass River	39.74238	-74.45228	BURLINGTON	Yes	River/stream
AN0753	Mill Ck off Spur 552 (Union Lk WMA) in Millville	39.42592	-75.08579	CUMBERLAND	Yes	River/stream
BFBM000059	Scotland Run On Route 47	39.59664	-75.06379	GLOUCESTER	Yes	River/stream
AN0742	Muddy Run at Dutch Row Rd in Elmer	39.58889	-75.16465	SALEM	Yes	River/stream
BFBM000145	Mantua Creek Off Blackwood Barnsboro Street	39.77017	-75.13291	GLOUCESTER	Yes	River/stream

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection	Habitat	Metrics	Indices
AN0144	Yes	Yes	Yes	No	No	No	No	No	No	No
AN0122	Yes	Yes	Yes	No	No	No	No	No	No	No
01467066	Yes	Yes	Yes	Yes	No	No	No	No	No	No
01464290	Yes	Yes	Yes	Yes	No	No	No	No	No	No
01411453	Yes	Yes	Yes	Yes	No	No	No	No	No	No
AN0126A	Yes	Yes	Yes	No	No	No	No	No	No	No
01411675	Yes	Yes	Yes	Yes	No	No	No	No	No	No
01464587	Yes	Yes	Yes	Yes	No	No	No	No	No	No
01477100	Yes	Yes	Yes	Yes	No	No	No	No	No	No
01475042	Yes	No	Yes	No	No	No	No	No	No	No
01477470	Yes	Yes	Yes	Yes	No	No	No	No	No	No
BFBM000015	Yes	Yes	Yes	No	No	No	No	No	No	No
AN0759	Yes	Yes	Yes	Yes	No	No	No	No	No	No
01413020	Yes	Yes	Yes	No	No	No	No	No	No	No
01413060	Yes	Yes	Yes	No	No	No	No	No	No	No
01411740	Yes	Yes	Yes	No	No	No	No	No	No	No
AN0709	Yes	Yes	Yes	No	No	No	No	No	No	No
01411457	Yes	Yes	Yes	No	No	No	No	No	No	No
01411461	Yes	Yes	Yes	No	No	No	No	No	No	No
0146453250	Yes	Yes	Yes	No	No	No	No	No	No	No
01464523	Yes	Yes	Yes	No	No	No	No	No	No	No
BFBM000256	Yes	Yes	Yes	No	No	No	No	No	No	No
01402540	Yes	Yes	Yes	No	No	No	No	No	No	No
01399720	Yes	Yes	Yes	No	No	No	No	No	No	No
BFBM000011	Yes	Yes	Yes	No	No	No	No	No	No	No
AN0521	Yes	No	No	Yes	No	No	No	No	No	No
AN0551	Yes	No	No	Yes	No	No	No	No	No	No
01409815	Yes	No	No	Yes	No	No	No	No	No	No
AN0597	Yes	No	No	Yes	No	No	No	No	No	No
01466000	Yes	No	No	Yes	No	No	No	No	No	No
AN0562	Yes	No	No	Yes	No	No	No	No	No	No
BFBM000236	Yes	No	No	Yes	No	No	No	No	No	No
BFBM000237	Yes	No	No	Yes	No	No	No	No	No	No
AN0605	Yes	No	No	Yes	No	No	No	No	No	No
AN0753	Yes	No	No	Yes	No	No	No	No	No	No
BFBM000059	Yes	No	No	Yes	No	No	No	No	No	No
AN0742	Yes	No	No	Yes	No	No	No	No	No	No
BFBM000145	Yes	No	No	Yes	No	No	No	No	No	No

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection
AN0144	DEP	DEP	NJDHSS	No	No	No	No
AN0122	DEP	DEP	NJDHSS	No	No	No	No
01467066	DEP	DEP	NJDHSS	DEP	No	No	No
01464290	DEP	USGS	NJDHSS	DEP	No	No	No
01411453	DEP	USGS	NJDHSS	DEP	No	No	No
AN0126A	DEP	DEP	NJDHSS	No	No	No	No
01411675	DEP	USGS	NJDHSS	DEP	No	No	No
01464587	DEP	USGS	NJDHSS	DEP	No	No	No
01477100	DEP	DEP	NJDHSS	DEP	No	No	No
01475042	DEP	DEP	NJDHSS	No	No	No	No
01477470	DEP	DEP	NJDHSS	DEP	No	No	No
BFBM000015	DEP	DEP	NJDHSS	No	No	No	No
AN0759	DEP	DEP	NJDHSS	DEP	No	No	No
01413020	DEP	USGS	NJDHSS	No	No	No	No
01413060	DEP	USGS	NJDHSS	No	No	No	No
01411740	DEP	DEP	NJDHSS	No	No	No	No
AN0709	DEP	USGS	NJDHSS	No	No	No	No
01411457	DEP	USGS	NJDHSS	No	No	No	No
01411461	DEP	DEP	NJDHSS	No	No	No	No
0146453250	DEP	DEP	NJDHSS	No	No	No	No
01464523	DEP	DEP	NJDHSS	No	No	No	No
BFBM000256	DEP	DEP	NJDHSS	No	No	No	No
01402540	DEP	USGS	NJDHSS	No	No	No	No
01399720	DEP	USGS	NJDHSS	No	No	No	No
BFBM000011	DEP	DEP	NJDHSS	No	No	No	No
AN0521	DEP	No	No	DEP	No	No	No
AN0551	DEP	No	No	DEP	No	No	No
01409815	DEP	No	No	DEP	No	No	No
AN0597	DEP	No	No	DEP	No	No	No
01466000	DEP	No	No	DEP	No	No	No
AN0562	DEP	No	No	DEP	No	No	No
BFBM000236	DEP	No	No	DEP	No	No	No
BFBM000237	DEP	No	No	DEP	No	No	No
AN0605	DEP	No	No	DEP	No	No	No
AN0753	DEP	No	No	DEP	No	No	No
BFBM000059	DEP	No	No	DEP	No	No	No
AN0742	DEP	No	No	DEP	No	No	No
BFBM000145	DEP	No	No	DEP	No	No	No

Geographic Regions	Lower Delaware, Atlantic Coast, Raritan
Counties	Salem,Gloucester, Burlington, Ocean, Atlantic, Cumberland, Somerset, Mercer
Dates	11/1/15-10/1/17
Status	In Progress-Discrete
Sample Frequency	Other (10x year)
Seasons Sampled	Spring, Summer, Fall, Winter
Waterbody Type	River/Stream
Salinity Category	Fresh
Tidal Influence	Non-tidal, Tidal
Project Description	The Regional Targeted Water Quality Network (RTWQN) purpose is to collect discrete and continuous chemical water monitoring data. The projects focuses on targeted regions with an increased temporal sampling frequency for greater comprehensive assesments.
Parameters analyzed type	Chemical/Physical (Conventionals, Nutrients, Metals)

Regional Targeted Water Quality Network
2015-2017



Attachment B: Lab Parameter Tables

Analysis (lab name)	EPA Characteristic Name	Method Speciation Name	Result Sample Fraction	Result Measure Unit	Result Value Type	Sample Collection Type	Sample Collection Equipment
NEW JERSEY DEPARTMENT OF	Alkalinity, total	as CaCO3	Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Ammonia-nitrogen	as N	Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Calcium		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Chloride		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Organic carbon		Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Organic carbon		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Hardness, carbonate		Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Chromium(VI)		Dissolved	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Magnesium		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	as N	Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Phosphorus	as P	Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Phosphorus	as P	Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Potassium		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Sodium		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Sulfate		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Total dissolved solids		Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Kjeldahl nitrogen	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Kjeldahl nitrogen	as N	Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Total suspended solids		Total	mg/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Arsenic		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Cadmium		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Chromium		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Copper		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Iron		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Lead		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Mercury		Total Recoverable	ng/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Nickel		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Selenium		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)
NEW JERSEY DEPARTMENT OF	Zinc		Total Recoverable	ug/l	Actual	Grab	Water Sampler (Other)
							Water Sampler (Other)

Parameter	Laboratory	Lab Number	Method	Method ID Context	Lower Reporting Limit	units	Method Detection Limit	units	Upper Reporting Limit (MPN/100 ml)	units	Holding Time	Preservative
Alkalinity	NEW JERSEY DEPARTMENT OF HEALTH - 11036		2320-B	APHA	1	mg/l	1				14 days	Ice to 4 deg C
Ammonia (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		4500-NH3(H)	APHA	0.05	mg/l	0.006				28 days	H2SO4 to ph < 2, Ice to 4 deg C
Calcium (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	0.1	mg/l	0.007				6 months	HNO3 to pH <2, Ice to 4 deg C
Chloride (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		4500-CL(E)	APHA	2.5	mg/l	0.113				28 days	Ice to 4 deg C
Organic Carbon (Total) (TOC)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		5310-C	APHA	0.5	mg/l	0.058				28 days	Ice to 4 deg C
Organic Carbon (Diss.) (DOC)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		5310-C	APHA	0.5	mg/l	0.058				28 days	Ice to 4 deg C
Hardness	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	0.662	mg/l	0.069				6 months	HNO3 to pH <2, Ice to 4 deg C
Chromium, Hexavalent (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		218.6	USEPA	0.1	ug/l	0.039				28 days	, 5mls ammoniumhydroxide/ammonium sulfateIce to 4 deg C
Magnesium (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	0.1	mg/l	0.006				6 months	HNO3 to pH <2, Ice to 4 deg C
Nitrite plus Nitrate (NO2-NO3) (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		4500-NO3(F)	APHA	0.012	mg/l	0.00487				28 days	H2SO4 to ph < 2, Ice to 4 deg C
Phosphorus (Total)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		365.1	USEPA	0.01	mg/l	0.00553				28 days	H2SO4 to ph < 2, Ice to 4 deg C
Phosphorus (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		365.1	USEPA	0.01	mg/l	0.00553				28 days	H2SO4 to ph < 2, Ice to 4 deg C
Potassium (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	0.1	mg/l	0.028				6 months	HNO3 to pH <2, Ice to 4 deg C
Sodium (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	0.1	mg/l	0.006				6 months	HNO3 to pH <2, Ice to 4 deg C
Sulfate (Dissolved)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		375.2	USEPA	10	mg/l	1.59				28 days	Ice to 4 deg C
Total Dissolved Solids	NEW JERSEY DEPARTMENT OF HEALTH - 11036		2540-C	APHA	1	mg/l	1				7 days	Ice to 4 deg C
Kjeldahl Nitrogen (Total) (TKN)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		351.2	USEPA	0.1	mg/l	0.046				28 days	H2SO4 to ph < 2, Ice to 4 deg C
Kjeldahl Nitrogen (Diss.) (TKN)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		351.2	USEPA	0.1	mg/l	0.046				28 days	H2SO4 to ph < 2, Ice to 4 deg C
Total Suspended Solids	NEW JERSEY DEPARTMENT OF HEALTH - 11036		2540-D	APHA	1	mg/l	1				28 days	Ice to 4 deg C
Arsenic (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.9	USEPA	1	ug/l	0.1				6 months	HNO3 to pH <2, Ice to 4 deg C
Cadmium (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.8(W)	USEPA	0.5	ug/l	0.02				6 months	HNO3 to pH <2, Ice to 4 deg C
Chromium (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	2	ug/l	0.238				6 months	HNO3 to pH <2, Ice to 4 deg C
Copper (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.8(W)	USEPA	1	ug/l	0.01				6 months	HNO3 to pH <2, Ice to 4 deg C
Iron (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.7(W)	USEPA	20	ug/l	0.94				6 months	HNO3 to pH <2, Ice to 4 deg C
Lead (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.9	USEPA	1	ug/l	0.16				6 months	HNO3 to pH <2, Ice to 4 deg C
Mercury (Total Rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		1631	USEPA	0.5	ng/l	0.2				90 days	BrCl, Ice to 4 deg C
Nickel (Total rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.8(W)	USEPA	0.5	ug/l	0.01				6 months	HNO3 to pH <2, Ice to 4 deg C
Selenium (Total rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.9	USEPA	1	ug/l	0.2				6 months	HNO3 to pH <2, Ice to 4 deg C
Zinc (Total rec.)	NEW JERSEY DEPARTMENT OF HEALTH - 11036		200.8(W)	USEPA	5	ug/l	0.2				6 months	HNO3 to pH <2, Ice to 4 deg C

Attachment C: Standard Operating Procedures for Making Discharge Measurements in Wadeable, Non-tidal Freshwater Streams with a Handheld Acoustic Doppler Velocimeter

Bureau of Freshwater and Biological Monitoring Standard Operating Procedure for Making Discharge Measurements in Wadable, Non-tidal, Freshwater Streams with a Handheld Acoustic Doppler Velocimeter (ADV)

With additional guidance from the United States Geological Survey, the New Jersey Department of Environmental Protection Bureau of Fresh Water and Biological Monitoring (NJ DEP/BFBM) adopted the Standard Operating Procedures from the manufacturer for using a handheld ADV and the United States Geological Survey Field manual.

Field Manual for United States Geological Survey:
http://training.usgs.gov/TEL/Nolan/SWProcedures/Index.html

I. Diagnostic Test Before Use – Before any sampling run, or quarterly, a system diagnostics test called a "beam check" should be performed in a lab environment. A beam check should show that signal amplitude plots from each probe are roughly the same, and should show noticeable peaks for "sample volume', "boundary reflection" and "noise level". If not, it is possible the probe(s) may be damaged. A complete description of "beam check" can be found in the manual. Should the meter fail the beam check, it will be removed from service and sent back to the manufacturer for repair.

II. Site Selection - In order to ensure that quality discharge measurements are made, it is important to select a location which minimizes the amount of interference and error during the measurement. Ideally, the location should be at a section of stream which is as straight as possible. If possible, avoid bends in the stream and areas of dead water. A general rule of thumb is that a transect location should be a distance (upstream and downstream) of 2X the width of the stream from any type of control, such as a riffle or pool or incoming tributary. Flow at the location should be as close to being laminar as possible. Once the location is selected, any moveable obstructions (small rocks, tree branches, macrophytes) should be removed from the transect.

III. Setting up a tagline - A tagline consisting of a tape measure will be set up perpendicular to the stream flow. The tape measure units should be in feet with sub-increments in 10ths of a foot. It is important that the line is taught and secure. Once established, a stream width will be determined from wetted edge to wetted edge. For the purpose of uniformity, the left edge of water will be determined by looking downstream.

IV. Measuring discharge - Measuring discharge involves wading across the stream/ river while taking measurements of water depth and velocity at different locations (based on ISO/USGS procedures) along a transect. By combining this information, the total discharge can be calculated.

A. Preparation

1. Divide the river cross-section into a number of stations appropriate for its width. According to the United States Geological Survey, 25-30 stations will give a representative measurement. There is a limitation however for streams <8.25 feet wide. The meter's probes measure at a distance of 4 inches from the probe face. Increments less than 4 inches (0.3 feet) will result in overlapping measurements. In these cases, it is acceptable to have as many increments as the stream width will allow. Below is a chart that can be used to determine how many increments to use for streams less than 8.25'

Stream Width	Number of Increments
8’	23
7.5’	21
7’	20
6.5’	18
6’	17
5.5’	15
5’	14
4.5’	12
4’	11
3.5’	9
3’	7
2.5’	6
2'	5
1.5’	3
1’	2
<1’	1

These are general guidelines and actual on-site conditions will determine how many increments can be done for a given stream. It should also be noted that the meter is incapable of measuring flows at a depth less than 3”, so increments at those depths may need to be omitted.

2. The starting edge is then established. The meter automatically defaults to left edge (descending bank or facing downstream), so it is
   advisable to begin on the left edge. If it is not possible, then the operator must change the starting edge to right (see manual).
   The operator must then establish the increments that will be used to measure velocity for the given stream width. For example if the stream is 26 feet width, the increment is 1.04 feet (26/25). This will give the operator the minimum required number of stations (25).
3. Facing upstream, orient the hand held ADV perpendicular to the tagline Velocity data is recorded once per second for the entire averaging time (40 seconds), and then averaged to compute the mean velocity. Quality control data is also reviewed and displayed; you will be alerted to any unexpected values. If the velocity measurement is found to be unsatisfactory, you should repeat the measurement.
4. During the entire measurement, the probe’s X-axis must be maintained perpendicular to the tag line. The probe should be held away from underwater obstacles that may disturb the flow. Do not turn the hand held ADV into the direction of flow, as it will automatically account for flow direction when making discharge measurements.

B. Starting the discharge measurement

1. Turn the handheld ADV on. Press ENTER to display the Main Menu.
2. Press 1 to enter the Setup Parameters Menu. Sampling Volume YX Probe Coordinate System Graduated Tag Line Primary Flow Direction Mounting Pin
3 At the Setup Parameters Menu, review the current settings and change the values to meet the requirements. To change a displayed value, press the number next to the relevant parameter.
4. Press ENTER to display more menu options. For example:
5. Press 2 in the Setup Parameters Menu to change the Averaging Time.
   The defaults for these parameters are: Units: English Averaging Time: 40 seconds Mode: Discharge Salinity: 0.0 ppt
   (freshwater) Discharge Equation: Mid Section When you are finished,
6. Press 0 to return to the Main Menu.
7. Now press 2 to enter the System Functions Menu.

C. Field-testing the hand held ADV

1. Collect and verify temperature data (press 4).
2. Check battery voltage (press 5). If voltage is at 60% or below, then a battery change is required before proceeding.
3. Collect and verify raw data. Ideally, SNR (signal noise ratio) values should be >10 dB, but 4 dB is acceptable (press 6).
4. Verify the internal clock is correct (press 9).
5. When you are done, press 0 to return to the Main Menu.

D. Enter site information

1. Press 3 to Start Data Run and display the Data File Name Menu.
2. Press 1 and enter a file name. To enter text names, use the same method as mobile phones (e.g., press 2 four times for "C"; 2–A–B–C). Now press 9 to accept the name. At any time during data collection,
3. Press 8 (QC Menu) to enter supplemental data including gauge height, rated flow, and user comments.

E. Collect station data

1. In the Starting Edge screen, enter the location, depth, correction factor, and starting edge using the marked buttons on the keypad. Note that LEW/REW stands for Left/Right Edge Water.
2. Press Next Station to continue. Enter the location, depth, and method of measuring velocity (changed by pressing Method +/-).
3. When the station information is complete, and the probe is at the correct depth and Orientation, press the Measure button. An updating display will show the measured velocity and SNR values. Keep the probe as steady as possible.
4. On completion of the averaging time, a summary will be displayed. Press 1 to accept and go to the next station or depth, or
5. Press 2 to repeat this measurement. These steps will be repeated for all stations until End Section is pressed.

F. Ending the measurement

1. When End Section is pressed, the ending-edge information is displayed. Enter the information for this edge. The Previous Station and Next Station buttons can also be pressed to review completed stations.
2. Press Calc Discharge to compute the total cross-sectional discharge for all completed stations.
3. Press 0 to return to the Main Menu.

You must always return to the Main Menu to make sure that all data is saved.

V. Quality Assurance Procedures

To ensure accuracy, NJDEP/BFBM will follow manufactures instructions for determining probe/meter condition. This consists of a beam check and ping test. The beam check is performed in a lab quarterly. The ping test is done in stream on a daily basis. These tests ensure that the meter and probe are operating within the manufacturers guidelines. If either of these tests are failed, a discharge measurement will not be made with that particular meter and the meter will be sent back to the manufacturer for repair. NJDEP/BFBM has also developed a quality assurance check for utilizing the handheld ADV. Each staff member qualified for performing discharge measurements will be required to have a flow comparison check against the ADR at the Pequannock River(USGS# 01382500) a USGS real time gage reading quarterly during their assigned visit. Any flow comparison at a USGS real-time station that is off more than 20% will be repeated. If the repeated measurement is still off by more than 20%, then that

staff member will undergo additional training. After the comparison is completed a hard copy will be stored of both the samplers discharge measurement and the ADR flow rate.
All discharge measurements made that are placed into records should have the flow rate (cubic feet per second) and also be designated a rank which determines the quality of measurement.

NJDEP/BFBM rank the quality of stream flow measurements by summing the International Organization of Standardization and Statistical uncertainty levels located on the data file (.WAD).

Rank:	**</= 5.0%**	**Very good**
	> 5.0 and </= 10.0%	**Good**
	>10.0% and </= 20.0%	**Fair**
	> 20.0%	**Poor**

All ranks should be entered with the data for viewing.

All projects and staff using the handheld ADV should adhere to the Standard Operating Procedures listed.

Attachment D : Data Reporting and Storage Tables

Field Name	WQDE Name	Media	Units
DO	Dissolved oxygen (DO)	Water	mg/l
Water Temp	Temperature, Water	Water	deg C
Spec Cond	Specific conductance	Water	uS/cm
pH	pH	Water	None
Flow	Flow	Water	cfs
Barometric Pressure	Barometric Pressure	Air	mmHg
DO Sat	Dissolved oxygen saturation	Water	%
Temperature, air	Temperature, air	Air	deg C
Turbidity	Turbidity	Water	NTU

QAPP network path file location?	V:\LUM\BFBM\Bfbm\Quality Assurance Plans\Calendar Year 2016 QAPPS\
Where will data be recorded in field (media)	Paper
If on tablets or phones, will download at office occur or will you connect wirelessly?	NA
If on tablets or phones, who will do the download?	NA
If data collected electronically, where will it be stored?	WQDE
Format to be received from Lab	LIMS
Method of receipt from lab/s	
Personnel receiving outside lab data	Carol O'Donnel-Kee
Is data expected to go to WQDE/STORET?	Yes
Data manager - (Bureau and Name)	BFBM Leigh Lager

Attachment E: NJDOH Standard Operating Procedures

Lab Method Number	Lab Method Revision Number	Reference Method	SOP Description	Sign-off	Date
ECLS-I-ICP-1	9	EPA 200.7	Aluminum, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Barium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Beryllium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Boron, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Cadmium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Calcium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Chromium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Cobalt, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Copper, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Hardness (Calcium)		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Hardness (Total)		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Iron, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Magnesium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Manganese, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Nickel, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Potassium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Sodium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Strontium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Tin, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Zinc, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Molybdenum, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Silica, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Silver, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Titanium, ICP		12/10/13
ECLS-I-ICP-1	9	EPA 200.7	Vanadium, ICP		12/10/13
ECLS-I-ICPMS-1	5	EPA 200.8	Aluminum, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Antimony, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Arsenic, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Barium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Beryllium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Cadmium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Chromium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Copper, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Lead, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Manganese, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Nickel, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Thallium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Zinc, ICPMS (WS)		4/14/13

Lab Method Number	Lab Method Revision Number	Reference Method	SOP Description	Sign Off	Date
ECLS-I-ICPMS-1	5	EPA 200.8	Molybdenum, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Selenium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Uranium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Uranium, Radiation		4/14/13
ECLS-I-ICPMS-1	5	EPA 200.8	Vanadium, ICPMS (WS)		4/14/13
ECLS-I-ICPMS-2	2	EPA 200.8	Aluminum, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Antimony, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Arsenic, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Barium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Beryllium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Cadmium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Chromium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Copper, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Lead, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Manganese, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Nickel, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Thallium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Zinc, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Molybdenum, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Selenium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Uranium, ICPMS (WP)		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Uranium, Radiation		4/11/14
ECLS-I-ICPMS-2	2	EPA 200.8	Vanadium, ICPMS (WS)		4/11/14
ECLS-I-GFAA-1	10	EPA 200.9	Antimony, GFAAS		12/10/13
ECLS-I-GFAA-1	10	EPA 200.9	Arsenic, GFAAS		12/10/13
ECLS-I-GFAA-1	10	EPA 200.9	Lead, GFAAS		12/10/13
ECLS-I-GFAA-1	10	EPA 200.9	Thallium, GFAAS		12/10/13
ECLS-I-GFAA-1	10	EPA 200.9	Selenium, GFAAS		12/10/13
ECLS-I-CVAA-2	2	EPA 245.1	Mercury, EPA 245.1		5/9/12
ECLS-I-ION-4	9	EPA 300.0	Bromide by Ion Chromatography		9/11/13
ECLS-I-ION-4	9	EPA 300.0	Chloride by Ion Chromatography		9/11/13
ECLS-I-ION-4	9	EPA 300.0	Fluoride by Ion Chromatography		9/11/13
ECLS-I-ION-4	9	EPA 300.0	Sulfate by Ion Chromatography		9/11/13
ECLS-I-FIA-6	7	EPA 335.4	Cyanide, Total		9/11/13
ECLS-I-FIA-5	5	EPA 351.2	Nitrogen, Total Kjeldahl (Dissolved)		9/11/13
ECLS-I-FIA-5	5	EPA 351.2	Nitrogen, Total Kjeldahl (Total)		9/11/13

Lab Method Number	Lab Method Revision Number	Reference Method	SOP Description	Sign off	Date
ECLS-I-VIS-6	13	EPA 420.1	Phenols		9/20/13
ECLS-I-GEN-3	10	SM 2120 B	Color		12/5/13
ECLS-I-GEN-1	11	SM 2130B	Turbidity		11/6/13
ECLS-I-GEN-4	9	SM 2150B	Odor		9/11/13
ECLS-I-ALK-1	5	SM 2320B	Alkalinity		11/4/13
ECLS-I-GEN-2	12	SM 2510B	Conductivity		11/4/13
ECLS-I-GRAV-3	11	SM 2540B	Solids, Total (TS)		11/6/13
ECLS-I-GRAV-1	11	SM 2540C	Solids, Total Dissolved (TDS)		11/6/13
ECLS-I-GRAV-2	12	SM 2540D	Solids, Total Suspended (TSS)		11/4/13
ECLS-I-SS-1	5	SM 2540F	Solids, Settleable		11/6/13
ECLS-I-VIS-4	12	SM 3500-Cr B	Chromium, Hexavalent		11/6/13
ECLS-I-VIS-7	13	SM 426 C (15th Ed.)	Sulfate, Turbidimetric, Non-Drinking Water		9/20/13
ECLS-I-ISE-1	12	SM 4500-F C	Fluoride by ISE		12/5/13
ECLS-I-PH-1	4	SM 4500H-B	pH		11/6/13
ECLS-I-FIA-3	8	SM 4500-NH3 H	Nitrogen, Ammonia - Distilled (Dissolved)		11/19/13
ECLS-I-FIA-3	8	SM 4500-NH3 H	Nitrogen, Ammonia - Distilled (Total)		11/19/13
ECLS-I-FIA-2	9	SM 4500-NH3 H	Nitrogen, Ammonia - Undistilled (Dissolved)		11/19/13
ECLS-I-FIA-2	9	SM 4500-NH3 H	Nitrogen, Ammonia - Undistilled (Total)		11/19/13
ECLS-I-FIA-1	8	SM 4500-NO3 F	Nitrogen, Nitrite (Total)		11/19/13
ECLS-I-FIA-1	8	SM 4500-NO3 F	Nitrogen, Nitrite (Dissolved)		11/19/13
ECLS-I-FIA-1	8	SM 4500-NO3 F	Nitrogen, Nitrite + Nitrate (Dissolved)		11/19/13
ECLS-I-FIA-1	8	SM 4500-NO3 F	Nitrogen, Nitrite + Nitrate (Total)		11/19/13
ECLS-I-O-1	5	SM 4500-O C	Dissolved Oxygen		9/10/13
ECLS-I-FIA-7	9	EPA 365.1	Phosphorus, Ortho (Dissolved)		8/26/13
ECLS-I-FIA-7	9	EPA 365.1	Phosphorus, Ortho (Total)		8/26/13
ECLS-I-OD-1	8	SM 5210B	CBOD		11/19/13
ECLS-I-OD-1	8	SM 5210B	BOD		11/19/13

Lab Method	**Lab Method**	**Reference**			
Number	**Revision Number**	**Method**	**SOP Description**	**Sign off**	**Date**
ECLS-I-VIS-8	13	SM 5220 D	COD - Low Level		11/19/13
ECLS-I-VIS-1	15	SM 5220 D	COD - Standard		11/19/13
ECLS-I-TOC-2	6	SM 5310 C	Organic Carbon (Dissolved)		10/25/13
ECLS-I-TOC-2	6	SM 5310 C	Organic Carbon (Total)		10/25/13
ECLS-I-VIS-2	14	SM 5540 C	MBAS		11/19/13
ECLS-I-FIA-10	4	SM4500-Cl E	Chloride		11/6/13
ECLS-I-FIA-11	4	EPA 365.1	Total Phosphorous		4/11/14
ECLS-I-FIA-12	1	EPA 375.2	Sulfate		1/30/13
ECLS-I-ION-CR6	0	EPA 218.6	Chromium, Hexavalent		10/31/13

Attachment F:Sensor Specifications for Continuous Monitoring Devices

Logger/Probe Type	Manufacturer	Model #	Range	Resolution	Accuracy
Temperature Logger	Onset	U22-001	- 40 to 50^0 C	0.02 °C at 25°C	+/- 0.21 from 0 to 50 C
pH	YSI	6 series	0-14 units	0.01 units	+/-0.2 units
pH	YSI	EXO	0-14 units	0.01 units	+/- 0.1 units within 10 DEGREES C,+/-0.2 units
D.O. optical	YSI	6150	0-50 mg/l	0.01 mg/l	0-20 mg/l +/- 1% of the reading or +/- 0.1 mg/l w
D.O. optical	YSI	EXO	0-50 mg/l	0.01 mg/l	0-20 mg/l +/- 1% of the reading or +/- 0.1 mg/l w
Turbidity	YSI	6163	0-1000 NTU	0.1 NTU	+/- 5% reading or 2 NTU (Whichever is greater)
Turbidity	YSI	EXO	0-4000 FNU	0-999 FNU: .01 FNU, 1000-4000 FNU: .1 FNU	0-999 FNU: +/-2% of reading (whichever greater
Conductivity	YSI	6560	0-100 mS/cm	0.001 mS/cm to 0.1 mS/cm (Range dependent)	+/- 0.5 % of reading +0.001 mS/cm
Conductivity	YSI	EXO	0 to 200 mS/cm	0.001 mS/cm to 0.1 mS/cm (Range dependent)	0-100 mS/cm:.001, 100-200 mS/cm: +/- 1%
Temperature	YSI	6560	-5 to 45 °C	0.01 ° C	+/- .15 °C
Temperature	YSI	EXO	-5 to 45 °C	.001 ° C	-5 to 35 C : +/- .01; 35-50 C +/- .05 C